DOCUMENT RESUME

ED 394 295 FL 023 691

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TITLE An Analysis of Computer Workstation and Handwriting Use by ESP Students.
PUB DATE Apr 96
NOTE 16p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS College Second Language Programs; Computer Assisted Instruction; English (Second Language); *English for Special Purposes; *Equipment Utilization; Facility Utilization Research; Foreign Countries; *Handwriting; Higher Education; *Technical Writing; *Workstations; *Writing (Composition); Writing Exercises; Writing Instruction; Writing Skills
IDENTIFIERS Japan; University of Aizu (Japan)

ABSTRACT

A study at the University of Aizu (Japan) investigated characteristics of technical writing assignments composed in English as a second language on computer workstations and by hand. The in-class workstation essays and hand-written essays of 24 students revealed that while all were of similar overall quality, the workstation essays were not as well organized and were significantly shorter in length than the hand-written essays. A questionnaire concerning both writing processes was then administered to these and 55 additional students. It indicated that while students generally felt that workstations contributed to learning English, there were a number of problems associated with their use, including: inability to see what the final paper will look like; less efficient work; teacher time spent teaching about workstation use; time spent at the workstation on other homework or other computer activities; and eye strain. It is concluded from these data and previous research that workstations are well-suited for some assignments, but that handwriting may provide students with greater control in others. (Contains six references.) (MSE)

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An Analysis of Computer Workstation and Handwriting Use by ESP Students

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Summary

During the first three terms of the Technical Writing course taught to all University of Aizu sophomores, it was noted that most students' in-class writings using the university's computer (workstation) network were shorter than their handwritten papers completed in shorter time periods. Therefore, writings by these methods were compared, and the handwritten papers were found to be significantly longer than writings produced on the network workstations during a similar time frame. In addition, the longer handwritten papers were better organized than the workstation writings. A questionnaire was used to determine the reason for the word count difference and to determine the writing preferences of the students. The results indicate that the students are most experienced with the pen/pencil method of writing, find it easiest to use, and think it is fastest for writing. However, they prefer to use workstations, feel that they made less errors using that method of writing, and slightly favor it as the best writing method for learning to write in English. From a teacher's point of view, there is a need to employ a variety of writing methods - handwriting, computer word processing, and workstations - for writing assignments. To facilitate this, changes in equipment, software, and/or class assignments are being considered to improve the in-class writing portion of the Technical Writing course.

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Introduction

Sophomore Technical Writing students at the University of Aizu are given a variety of writing tasks. Some of the assignments are completed in-class either by handwriting or on networked workstation computers. The handwritten papers generally are 20 minute essay answers to quizzes given at the beginning of most weekly 90 minute classes. This method of quizzing is used to give the students an opportunity to write extemporaneously. These weekly quizzes have

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aided the students in developing the ability to formulate quick written responses in paragraph format. In addition, 90 minute midterm and final examinations for each of the two terms involved are handwritten essays.

Other in-class writings - exercises and homework preparation writing activities during 40 to 60 minutes time periods - are completed on the university's networked workstations. Since the students have had one year workstation experience in their freshman Computer Literacy and English Composition courses, they are fairly skilled in typing and entering computer commands. In addition, they are familiar with formatting and writing of English paragraphs and short compositions. However, the workstation writings of most students are usually much shorter than their handwriting papers.

Although homework assignments are completed on the workstations, there is no concern about using this method of writing for these tasks. The assignments are written on the workstations because they are longer, involve the review and revision process, require a well formatted final document, and may be completed at anytime prior to an established deadline. Workstation features also contribute to the efficient completion of these writings which require an investment of significant time for planning, researching, organizing, drafting, reviewing, revising, formatting, and printing of the papers. Since the university has sufficient workstations for the students to use after normal school hours, equipment availability is not a restricting factor.

In addition, the use of the workstations for homework assignments, aids the students in improving their typing skills and computer application knowledge without detracting from their English language education. This cannot be unequivocally stated for the use of workstations for in-class writings. Experience indicates that use of workstations for the in-class writings is, for most students, less efficient than handwriting and results in students using English writing class time for unrelated activities. This study attempts to measure the students' output using these two methods of writing and to obtain their views on the use of workstations for English writings.

Comparison of In-Class Writings:

For a midterm test, students were assigned to outline and write essays on the Technical Writing Process. One 90 minute class period was allotted for these tasks. The actual division of time was left to the students, but it was suggested that no more than 30 minutes be spent on planning and outlining the essay. This would allow 60 minutes to write the actual paper. Monitoring of the class indicated that the time on the outlining task varied from approximately 15 minutes to about 50 minutes. Therefore, it is most likely that the students

averaged 60 minutes on their essays. The average length of the "outlines" produced by the 26 students was 63.8 words, and the average essay was 226.4 words long.

Four class periods later, the same students were given 60 minutes to write several paragraphs discussing the University of Aizu and changes that would improve it. Since this work would be collected and graded, the students were reminded several times to work on their English writings and were monitored for compliance. However, it is difficult to control how the students actually use their workstation time because they display multiple windows on their monitors which allows them to swiftly switch between workstation activities.

At the end of the class, the students were directed to electronically transmit their work to their professor. Twenty-two of the writings from the 26 student class were received within five minutes of the request. One writing was received 13 minutes after the class ended. However, two other writings were received five hours after the class period ended, and one writing was never received. The two late transmissions and the one failure to transmit indicate that the class time of at least these three students was probably spent on non-assignment related activities.

Although the in-class writings were of similar overall quality as the handwritten papers, they were not as well organized and were significantly shorter. The poorer organization may be partially attributed to the fact that the students were not instructed, nor prompted, to complete and submit an outline. However, the shorter length of the writings was a matter that needed further investigation.

Closer Review of the Writings:

When the handwritten papers of the 26 first semester Technical Writing students were reviewed, several word counts were tabulated. These word counts were words per outline, words per essay, and total words per writing. In addition, a sentences per essay count was made, and the associated average words per sentence count was also calculated. This data is recorded in Table I of Appendix I.

The outlines ranged from 27 to 110 words in length with the average outline being 63.8 words, and the handwritten essays ran from 0 to 383 words with a 226.4 word per essay average. The total writings ranged from 96 words to 448 words, with an average of 290.3 total words per paper. A review of Appendix I will disclose that student number 16 completed a 96 word outline, but apparently suffered from writer's block and was unable to write an essay. When asked about this, the student informed his teacher that the essay had

been started and then erased because it was not good enough. Computer-assisted writing has been touted as a viable tool to help students reduce writing apprehension and blocking (Phinney, 1991), but this was not the case for this student. However, there does not appear to be much actual research on the affects of computers on apprehension of either L1 or L2 writers. (Phinney, 1991)

The workstation (WS) essays of the 26 students ranged from 0 to 234 words. The average length of all writings including the zero word writing and an eight word writing - "I could not find a topic in class." - was 129.3 words. It is noteworthy that this eight word writing was submitted by the same student (16) who completed the 96 word outline and zero word essay on the handwritten assignment. The zero word writing was that of a student who did not forward an in-class writing as requested. A discussion with Student 16 revealed that he lacked confidence in his ability to write even though he was an average student in his verbal communications. In addition, his daily quizzes, although short, did not indicate that he had this lack of confidence. The workstation writing data for the 26 student class is detailed in Appendix I.

Since two students (16 and 18) had zero word count essays in one of the writings, those students' essays were omitted from the following comparisons and are not included in the **Total**, **Mean**, and **Std Dev** data computed for this study. However, the writings of the students who submitted their writings some five hours after class were included. An attempt was made to determine the reasons for the one missing workstation writing, but Student 18 did not have an excuse for not submitting a writing.

A comparison of the writings completed by the 24 students involved in this study shows that the handwritten essays of 20 students were longer than their workstation writings, one was basically the same length (within 3 %) of the handwritten paper, and three were shorter. The handwritten essays averaged 1.91 times the workstation writings with a range of .48 to 4.13 times. The handwritten total writing (outline + essay) was 1.59 times the adjusted (multiplied by 1.5 to compensate for the time difference) workstation writing with a range from .50 to 3.22 times. The standard deviation for the **Means** of the handwritten - workstation writing ratios were 0.869 and 0.682 respectively. It should be noted that excluding the two in-class writings that were five hours late would have resulted in the **Means** of the ratios being altered only slightly to 1.85 and 1.54 respectively. This data is summarized in Table 1 on the following page and in more detail in Appendix I.

Because of the vast difference it the writing lengths, it was decided that information was needed to determine the writing experience of the students, their views of the difficulty of the workstation use, and their preferences for

writing. Therefore, a questionnaire (in English) was developed and administered to these and 55 other students. As a follow-up, 25 additional students completed the writing method experience portion (Table II, page 1 of 4 in Appendix II) and wrote several paragraphs discussing the good and bad points of using workstations to learn English writing.

Comparison of Writings Summary

	Handwritten (HW)			Workstation (WS)	Ratios	
	30 min Outline Words	60 min Essay Words	90 min Total Words	60 min Essay Words	HW Essay: WS	HW Total: 1.5 WS
26 Student Average	63.8	*226.4*	*290.3*	*129.3*	*1.85*	*1.54*
24 Student Total	1454	5685	7139	3353	-	-
Mean	60.6	**236.9**	**297.5**	**139.7**	**1.91**	**1.59**
Std Dev	25.83	**75.02**	**87.08**	**46.09**	**0.869**	**0.682**

Table 1

Student Responses to Questionnaire:

The data obtained from the questionnaire used in this study is tabulated in Appendix II. Table II, Page 1 of 4, (Appendix II) indicates that the 96 surveyed students were most experienced in the Pen/Pencil method of writing English followed by workstation writing. Computer and Word Processor English writing were ranked closely together as the third and fourth most used writing methods, and the Typewriter was ranked as a distant fifth method with 50 of the 96 students indicating that they had never used a typewriter to write in English. The rankings for *Easiest to Use* and *Fastest for Writing* were quite similar to the *Used Most* ranking except Word Processing was ranked as third slightly above Computer writing.

In the remaining three rankings - *Make Least Errors Using, Prefer to Use,* and *Best for Learning* - the Workstation was ranked first followed by Pen/Pencil. Computer and Word Processor writing continued to be ranked closely together as either three or four, and the Typewriter method continued to remain fifth in all rankings.

The remainder of the questionnaire was designed to ascertain the students feelings about using workstations to write English papers. A few repetitious questions were included to serve as validation of the students answers. Although the students were not sure if their workstation writings were longer than their handwritten papers, they moderately agreed with the statement that workstation use helped to learn to write in English and made learning English somewhat enjoyable, and they agreed with the statement that workstation writing was a better method than handwriting.

Moreover, it appears that the students do not believe that workstation use hinders their concentration on English writing tasks nor do they report that the application programs are too difficult or time consuming. The students obviously have a positive attitude about using the workstations for English writings. They indicate that the workstation software contains tools that are useful in drafting and revising their writings. On the other hand, they report that they use their personal dictionaries rather than the workstation dictionary.

The pros and cons pertaining to workstation use (Student Remarks in Appendix II) were obtained from the questionnaire administered to 25 students who were asked to write several paragraphs discussing the good and bad points of using workstations for English writings. Although the students primarily placed emphasis on the advantages of workstation use, the number of different bad points identified were more numerous than the number of different good points. Their comments confirmed the following recognized problems associated with workstation writings:

1. The workstation display screen does not show what the final paper will look like.
2. A bad point of using the workstation is poorer efficiency of work.
3. The English teacher has to spend time teaching about the workstation.
4. Students study for other classes when using a workstation.
5. Workstation use causes eye strain which require students to take periodic breaks.
6. Some students use e-mail or play games during English class.

Analysis of Data:

It is obvious that the complexity of the workstation writing and formatting programs and the wide range of distractions available on the networked system adversely affect the students' writing output. Lower production, total word output, with no increase in quality of the in-class writings were the observed results of this case study.

When students write by pen/pencil, their activities are more easily monitored and controlled. The students sit at writing tables facing the instructor, and all the students and their writing activities can be easily seen. The students have a tendency to concentrate on their assigned writing tasks. Whereas, in the computer workstation room, it is impossible to see all the students at any one time, let alone monitor their writing activities. The instructor must walk through three classroom rows and can see, at the most, only ten computer workstations at one time. The majority of the students can readily invest time on various activities not related to English writing, such as enjoying tours through Internet and studying for other classes.

Other studies have noted that students tended to spend considerably more time (perhaps 2-3 times) on Computer-Assisted Language Learning (CALL) exercises than on the non-CALL exercises. This may have been time needed by students to key the answers, or it may have been that the enjoyment of the task or benefit that the students were deriving from it justified spending considerably longer. (Windeatt, 1986)

In addition, this and previous research noted that writers using a computer tend to do less planning than they do with their handwritten writings. The results of the previous English writing research pertaining to computer users that support this position are:

1. An empty, blinking screen causes some users to start writing before they are ready. (Huckin, 1991)

2. The desire to start computer input without adequate planning results in writers "feeling their way" towards the formulation of their main ideas and the structure of their text. (Wikborg,1992)

3. The small screen limits the amount of text visible to the writer and causes the writer to focus on small issues rather than on overall organization, the readers, and purpose.(Huckin, 1991)

4. The limited text visible on the screen make it difficult for the writer to keep main ideas in mind and hinders text coherence. (Wikborg, 1992)

5. The ability to jump around induces writers to work on several sections of the text at the same time. This causes problems in maintaining continuity of thought. (Wikborg,1992)

6. The ease of making minor corrections causes the writer to concentrate on editing rather than basic changes in organization. (Huckin, 1991)

Moreover, past research indicates that computers do not seem to have much of an impact on students' motivation to learn the subject they are studying even though they may report that they like to use computers. (Dunkel, 1991) The students in this study appear to be biased towards the use of computers for the English writing tasks because they are computer science majors. Probably the most significant indication of their true feelings pertaining to the use of computers for in-class English writings is the following fact. When this class was offered a choice of the workstation or pen/pencil as the method of writing for their next graded in-class writing they selected the pen/pencil option. Only two of the 23 students present selected the workstation option. The main reason given for this selection was that they can write more by pen/pencil than by workstation.

Although the students involved in this study contend that workstation use aids the revision process, the quality of their timed in-class writings do not support this. Poor organization and the number of spelling and word choice errors indicate that limited revision and editing has been accomplished. However, some linguists claim that any revisions made by inexperienced writers do not help, and possibly damage, their texts because the revisions are merely at a local(surface level) of spelling, morphology, and word choice. They also contend that inexperienced L2 writers lack planning and reviewing skills and do not evaluate the text with the reader in mind. (McDonough, 1995)

Obviously, computers have their place in an English language writing classroom, especially at a computer science university. However, the benefits attained from the use of computer workstations for a writing task must be greater that the costs involved. The educational purpose of the class, teaching of English writing, must be given primary consideration. The students desire to gain experience with the workstation and its software is understandable, but it should not dictate the structure of their English writing classes.

Workstations are well suited for assignments in which the students have sufficient time to make use of the computer tools available without detracting from the primary purpose of the class, learning to write in English. Homework assignments involving long essays or formal papers that need to be well formatted, reviewed, and revised are suited to this method of writing. However, writings aimed at improving the students production also need to be included

in L2 class activities. Therefore, handwriting of short papers has an important role in the English writing classroom. It can be used to help students to develop an ability to formulate and write well structured paragraphs quickly.

In addition, some students have suggested utilizing personal computers (PCs) in the English writing class. This suggestion deserves serious consideration. It involves a much more realistic approach for completing in-class computer writings that need to emphasize learning of a second language writing skill. PC word processing software is much more user friendly than the workstation software, and the computer skills required of the students is much less than those needed for workstation operations. Also, the students are less tempted to stray from their primary class activities, are able to view an on screen representation of their papers, and can have easy to use computer aids available for the checking of spelling and grammar.

Conclusions

Students need to be exposed to a variety of writing methods in English writing classes. Each method has its advantages and disadvantages, and the English writing class curriculum needs to be designed to use the advantages of each. Although the workstation method of writing is favored by the majority of students in this study, its sole use does not ensure that the primary goal of the class, teaching students English writing, is meet. The use of workstations for English writings is best suited for the completion of long, formal papers and other homework assignments where time is not a factor.

However, workstation use for in-class writings needs to be tempered. Although considered antiquated by many teachers, the pen/pencil method has its place in the writing curriculum. It is the most familiar writing method for the students involved in this research. It is also the most efficient for the students at this level of English writing ability. The students can produce significantly more text by pen/pencil than by workstation during a limited time period, and the text is better organized than a workstation writing under the same time restrictions.

Another approach that also deserves consideration is the acquisition of more user friendly workstation software. Word processing software that is similar to PC software can be acquired. This approach, however, does not deal with the problem of maintaining class interest in the English writing assignments. The workstation is still a networked system that permits the user to display a number of screens at one time and access numerous network sites. Therefore, the use of personal computers (PCs) for the English writing classroom must be given consideration. Some students have shown an interest in using PCs.

Since PCs are the most popular type of computer, their use in the English writing laboratory would benefit the students by exposing them to experience on equipment that they are very likely to use in the immediate future.

In addition, the students involved in the in-class computer writing portion of this study tended to do little planning. Most of the students read the assignment, turned on their computers, and started their computer input. Very few students wrote any notes or prepared any type of outline. Therefore, it is evident that more classroom emphasis is necessary to help students implement adequate planning skills into the writing process.

This study has only brushed the surface of the problems involved. Further study of this matter is necessary to determine the best course of action for the students. In addition, continued review of the writing curriculum, the classroom equipment, and the software involved is necessary to ensure an effective English writing program.

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Appendix I:

Comparison of Writings

	Handwritten (HW)					Workstation (WS)			Ratios	
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11
Student	30 min Outline Words	60 min Essay Words	90 min Total Words	Sent/ Essay	Avg Words/ Sent	60 min Essay Words	Sent/ Essay	Avg Words/ Sent	HW Essay: WS	HW Total: 1.5 WS
01	77	350	427	22	15.9	110	8	13.8	**3.18**	**2.59**
02	29	130	159	12	10.8	167	16	10.4	**0.78**	**0.63**
03	92	383	475	31	12.4	198	17	11.6	1.93	1.60
04	80	264	344	16	16.5	*112*	*9*	*12.4*	*2.36*	*2.05*
05	75	327	402	27	12.1	207	13	15.9	1.58	1.29
06	50	230	280	21	11.0	149	12	12.4	1.54	1.29
07	68	283	351	28	10.1	156	17	9.2	1.81	1.50
08	32	222	254	18	12.3	124	10	12.4	1.79	1.37
09	27	182	209	19	9.6	107	9	11.9	1.70	1.30
10	39	227	266	16	14.2	55	3	18.3	**4.13**	**3.22**
11	91	319	410	26	12.3	186	10	18.6	1.72	1.47
12	41	288	329	22	13.1	91	7	13.0	**3.16**	**2.41**
13	38	172	210	17	10.1	148	8	18.5	1.16	0.95
14	103	193	296	18	10.7	187	17	11.0	**1.03**	1.06
15	33	217	250	15	14.5	99	6	16.5	2.19	1.68
16 *	*96* *	*0* *	*96* *	*0* *	- *	*8* *	*1* *	*8.0* *	*	*
17	97	181	278	16	11.3	80	8	10.0	2.26	**2.32**
18 *	*110* *	*202* *	*312* *	*18* *	*11.2* *	*0* *	*0* *	-	*	*
19	61	207	268	20	10.4	172	14	12.3	1.20	1.04
20	27	257	284	21	12.2	*92*	*8*	*11.5*	**2.79**	2.06
21	66	178	244	14	12.7	151	14	10.8	1.18	1.08
22	96	214	310	22	9.7	81	7	11.6	**2.64**	**2.55**
23	64	113	177	10	11.3	234	16	14.6	**0.48**	**0.50**
24	55	121	176	14	8.6	159	15	10.6	**0.76**	**0.74**
25	86	362	448	27	13.4	171	11	15.5	2.12	1.75
26	27	265	292	19	13.9	117	9	13.0	2.26	1.66
Total*	1454	5685	7139	471	-	3353	264	-	-	-
Mean	60.6	**236.9**	**297.5**	19.6	12.1	**139.7**	11.0	13.2	**1.91**	**1.59**
Std Dev	25.83	**75.02**	**87.08**	5.35	1.99	**46.09**	4.0	2.75	**0.869**	**0.682**

* The writings of students 16 and 18 are not included in the Total or Mean counts nor Standard Deviations.

Table I

Appendix II:

Sophomore Student Writing Methods

Writing Method - Ranking		Used Most	Easiest to Use	Fastest for Writing	Make Least Errors Using	Prefer to Use	Best for Learning
Pen/Pencil:	1	**86**	**75**	**61**	37	40	**48**
	2	7	13	12	19	25	20
	3	3	7	11	16	18	16
	4	0	1	5	13	7	1
	5	0	0	7	11	6	11
	Never Used	0					
	Rating	**467**	**450**	**403**	346	374	381
Typewriter:	1	0	1	3	1	0	0
	2	1	6	10	5	3	5
	3	3	9	8	8	8	5
	4	10	10	11	13	13	12
	5	32	20	14	19	22	24
	Never Used	**50**					
	Rating	65	96	115	94	84	83
Word Processor:	1	1	0	3	7	4	3
	2	4	15	21	17	11	7
	3	31	30	30	29	32	34
	4	33	23	14	16	25	29
	5	6	7	7	6	3	2
	Never Used	**21**					
	Rating	186	203	224	228	213	205
Personal Computer:	1	2	2	3	5	5	5
	2	10	15	15	26	25	25
	3	36	26	24	19	22	23
	4	17	17	20	15	11	14
	5	6	11	9	6	8	4
	Never Used	**25**					
	Rating	198	193	196	222	221	226
Workstation:	1	6	17	26	**48**	**50**	44
	2	73	46	37	29	29	37
	3	15	18	17	11	8	10
	4	1	8	8	5	5	2
	5	1	7	8	3	4	3
	Never Used	0					
	Rating	370	346	353	**402**	**404**	**405**

Table II - Part 1 of 3

Sophomore Student Writing Methods

Summarized Students Answers Pertaining to Workstation use for English writings.	Strongly Agree (2)	Agree (1)	Unsure (0)	Disagree (-1)	Strongly Disagree (-2)	Average Rating
6. Writings are longer than if handwritten.	7	21	17	21	5	0.06
7. Improves quality of writings.	17	38	12	4	0	0.96
8. Can concentrate on English more.	4	27	21	15	4	0.17
9. Emacs and LaTeX are easy to use.	27	29	10	5	0	1.10
10. Spellcheck useful and used often.	28	24	5	12	2	0.90
11. Helps learning to write in English.	15	30	17	9	0	0.72
12. Network use improves content of writings.	6	24	33	8	0	0.39
13. Better writing method than handwriting.	19	31	13	7	1	0.85
14. Pay more attention to word selection.	11	22	24	13	1	0.41
15. WS better than PC or Word Processor.	14	23	22	10	2	0.52
16. Pays more attention to organizing material.	3	34	28	5	1	0.46
17. Uses personal dictionary often.	25	32	4	7	3	0.97
18. Requires little typing skill.	11	22	18	17	3	0.30
19. WS dictionary useful and used often.	8	19	6	27	11	-0.20
20. Programs designed for teaching English.	6	34	22	9	0	0.52

Table II - Part 2 of 3

Sophomore Student Writing Methods

Summarized Students Answers Pertaining to Workstation use for English writings.	Strongly Agree (2)	Agree (1)	Unsure (0)	Disagree (-1)	Strongly Disagree (-2)	Average Rating
21. Makes writing English papers enjoyable.	8	25	31	7	0	0.48
22. Best method for learning English writing.	12	28	23	7	1	0.61
23. Revises papers often when using WS.	12	36	20	1	2	0.77
24. Spends much time on LaTeX commands.	5	16	13	25	12	-0.32
25. More attention given to correct grammar.	10	33	18	9	1	0.59

Table II - Part 3 of 3

Student Remarks:

	Pros	Cons
1.	Using a workstation helps learn English and computers since all commands use English.	Time is spent learning about computers not learning English.
2.	I prefer to write on a computer because of the dictionary and the information available.	Most students do not know how to use workstation tools such as the on-line dictionary and spellcheck.
3.	Spelling can be checked on a workstation.	Many typing errors are made when using a workstation.
4.	The paper from a workstation is much neater and easier to read.	Writing on a workstation takes longer than writing by hand.

Student Remarks (cont):

	Pros	Cons
5.	Using a workstation makes it easier to revise a paper.	The workstation display screen does not show what the final paper will look like.
6.	Using a workstation, we learn typing and English at the same time.	A bad point of using the workstation is poorer efficiency of work.
7.	Typing on a keyboard helps learn English words.	When using pencil and paper, it is easy to learn and remember new words.
8.	A workstation is useful for writing English because it is fast and easy to use, ...	....., but it is hard to learn new words and grammar on the workstation.
9.	However, English writing is not only for studying English. It is also for learning computers.	Pencil and paper is faster than a workstation.
10.	.	Sometimes the teacher has to spend time teaching about the workstation.
11.		When using a workstation, students study for other classes.
12.		Since it causes eye fatigue, a workstation cannot be used for a long period of time. A user needs a rest every 30-40 minutes.
13.		Some students use e-mail or play games during English class.